

DRAFT FOR COMMENT

A PROPOSAL FOR THE DEVELOPMENT OF POLE-AND-LINE
FISHERIES FOR SKIPJACK TUNA
IN THE CENTRAL AND WESTERN PACIFIC

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DEVELOPMENT OF POLE-AND-LINE FISHERIES FOR SKIPJACK TUNA
IN THE CENTRAL AND WESTERN PACIFIC

Summary

What: Define the bait supply problem for pole-and-line skipjack tuna fishing for island governments of concern to the United States and evaluate several of the more promising bait fishing systems, including development of local fisheries using naturally occurring baitfish stocks and culture of suitable baitfish species.

Plan and develop bait fishery modules suitable for the various island governments in the central and western Pacific which should provide immediate economic benefits to the people of the Pacific islands.

Final Results

If the various problems are overcome and the economic situation proves acceptable, the long-range results to be expected are:

- Decrease in dependence on foreign sources for tuna for U.S. canners.
- Increase in economic viability of the central and western Pacific peoples through development of a new or expanded industry.

Program Details

Where: • The major portions of the work will be centered at locations best suited for the various activities.

When: • Portions of the program could start in January 1975.
The first phase should be completed at the end of 1975.

How much: The total cost of the 3-year program, if fully supported, is estimated at \$1.1 million.

DEVELOPMENT OF SKIPJACK TUNA FISHERIES
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Background

A great deal of information on the fishery resources in the central, south, and western Pacific, particularly on tuna and tuna-baitfish, has been obtained during the past 25 years (Appendix 1-5). Thus, an excellent base of data is now available for the development of commercial operations. In recognition of this, recent efforts have been made by the Pacific Islands Development Commission (PIDC), the United States tuna industry and the United States government separately and in concert to launch an expanded program for tuna fisheries development in the area (Figure 1).

In July 1972, the Marine Resources and Development Committee (MRDC) of PIDC proposed a plan for the development of tuna resources in the central, south, and western Pacific. This plan was prepared in anticipation of passage of P. L. 92-444 (H. R. 12207) on September 29, 1972, "The Central and Western Pacific Fisheries Development Act." The bill authorizes the expenditure of \$3 million over a 3-year period (July 1, 1972-June 30, 1975).

Because of the increasing importance of developing a substantial skipjack tuna fishery in this area of the Pacific, the National Marine Fisheries Service (NMFS) examined the PIDC plan and reviewed other available information on the resources and the fisheries. Following this review a draft document entitled, "Central and Western Pacific

Tuna Fishery Development Program" was prepared by NMFS Southwest Fisheries Center (SWFC). Subsequently, another document entitled, "A Cooperative Program for Development of the Tuna Resources of the Central, South, and Western Pacific," which is a synthesis of the PIDC and NMFS plans, was jointly prepared by NMFS and tuna industry representatives for approval of the several interested parties.

In October 1974, the United States government, under authority of P. L. 92-444, released funds to initiate work outlined in the NMFS-PIDC document. The United States tuna industry and the PIDC governments also contributed funds toward this work. Briefly, the main thrust of the program is to develop purse seine fishing techniques for skipjack tuna in the central and western Pacific.

The Problem

The island regions and elements of the tuna industry have common interests in fishery development, but they also have some quite different objectives. Each would agree that there is a need to establish historical fishing rights in the vast area of the central and western Pacific in order to assure access to the tuna and other high-seas fishery resources and a voice in their management. Beyond that, however, the island interests look to the harvest of the resources to contribute to the employment of their people and their overall economic development and the United States industry looks to the region for an additional supply of raw material. Thus, although the PIDC

governments will accrue economic benefits by the implementation of the NMFS-PIDC plan, which emphasizes work on developing techniques to purse seine for skipjack tuna in the waters of the central and western Pacific, the economic gain to the peoples of the Pacific would be greater if the fishery development work emphasized other aspects of the problem. The development of live-bait, pole-and-line fisheries presumably would involve greater participation by the peoples of the Pacific and therefore make a greater contribution to the overall economic development of the area. However, the development of a pole-and-line fishery requires first a need to resolve the various problems with baitfish which to date have constrained establishment of new fisheries for skipjack tuna or the enhancement of existing fisheries in many areas of the Pacific.

PROPOSED TASK AND ACTIVITIES FOR THE DEVELOPMENT OF SKIPJACK TUNA
FISHERIES IN THE CENTRAL AND WESTERN PACIFIC

Briefly summarizing the situation detailed earlier, it was pointed out that the direction of the work initiated under P. L. 92-444 would primarily benefit elements of the United States tuna industry although some benefits will also accrue to the PIDC governments. A program that would be more responsive to the needs of the peoples of the Pacific islands would be a program for the development of live-bait, pole-and-line skipjack tuna fisheries. Benefit will also accrue to the United States tuna industry from this program in that, if successful, this program would provide more raw material for the tuna canners. However, it was also pointed out that one of the important constraints on the development of new skipjack tuna fisheries in the Pacific has been the various problems with baitfish.

It is proposed, therefore, that a concerted effort be made to resolve the various problems with baitfish that have constrained establishment of new fisheries for skipjack tuna or the enhancement of existing fisheries in the Pacific. Furthermore, as advances are made toward the solution of these problems, assistance would be provided the various island groups in developing skipjack tuna fisheries by the application of the knowledge gained. An activity network for the program is shown in Figure 2.

Task. Development of live-bait, pole-and-line fisheries for skipjack tuna in the central and western Pacific.

Problems associated with baitfish have impeded the development of pole-and-line fisheries for skipjack tuna in several different ways. First is the scarcity or lack of suitable baitfish species. Examples of this situation are American Samoa and the Line Islands. Another problem is that in areas with naturally occurring baitfish, the supply has been erratic, thus contributing to a less than maximal development of a skipjack tuna fishery. Hawaii is a prime example of this situation. Another problem related to naturally occurring baitfish is the high mortality associated with handling, especially with some of the more delicate species.

A preliminary evaluation of the baitfish problem indicated that the transport of baitfish from areas of high abundance, e.g., California and Central America, to areas of high skipjack tuna density-low baitfish availability, e.g., Hawaii, French Polynesia, American Samoa, may be a practical and effective method to solve the supply problem (Appendix 6). Work on this project to determine the feasibility of a California to Hawaii system is now underway at the Honolulu Laboratory. Answers to the question of whether it would be feasible to transport the northern anchovy, Engraulis mordax, from California to Hawaii on a commercial scale should be forthcoming by early 1975. If the answers are positive the plans are to work closely with the tuna industry in Hawaii to launch a full-scale commercial baitfish transport operation.

Other possible solutions to the baitfish problem were explored at a baitfish workshop sponsored by the SWFC and Sea Grant (UH) held in Honolulu in June 1974 (Appendix 7-11). The workshop was planned so that guidelines could be obtained as to the optimal strategy to follow in attacking the baitfish problem, especially as it relates to skipjack tuna fishing activities in the Pacific.

Also, in an earlier effort to plan a draft program for tuna development in the central and western Pacific and to delineate the possible role of NMFS in the overall program, it was realized that what was needed was a framework for systematically analyzing the fishery development prospects--area by area. This modular approach allows the identification of each of the necessary factors for tuna fisheries development (e.g., resources, bait supply, socio-economic situation, etc.). The plan for each module will define the status of each of the factors and the necessary action required to remove any constraints limiting development.

In view of the foregoing the study area of this task, then, should include various aspects of the baitfish problem such as supply, condition and alternate methods to augment the natural bait supply. As advances are made in the baitfish program activities will be initiated in the development of pole-and-line fisheries. The following provides a list of the possible activities covered by this task and a brief description of each activity.

<u>Title</u>	<u>Duration</u>	<u>Estimated man-months</u>
Bait fishery development		
1. Bait surveys	16	28
2. Assessment of potential baitfishes	12	24
3. Pilot bait culture facility	12	24
4. Bait substitutes	9	9
5. Optimal fishing strategy	9	-
6. Design bait fishing module and infrastructure	9	9
7. Management of baitfishes	9	9
8. Extension service	Continuing	
9. Fishery liaison	Continuing	
10. Literature search	6	6

Activity 1. Conduct field surveys to determine occurrence of new potential baitfishes.

This activity should include the preparation of a document showing all previous bait survey work in the central and western Pacific. This project will seek to assist the various administrators of the region in planning and conducting bait surveys to seek out new potential baitfishes.

Activity 2. Assessment of cultured species as potential baitfishes

One of the solutions to the baitfish problem is to devise a system to provide cultured baitfish for skipjack tuna fisheries. For various reasons, e.g., fishermen acceptance of cultured baitfish, past attempts at bait culture have not been very successful. To increase the chances of success, all aspects of baitfish culture should be examined. A number of subactivities are described below.

Subactivity a.--Conduct acceptability field trials using threadfin shad, Dorosoma petenense, in the Hawaiian pole-and-line fishery for skipjack tuna.

The threadfin shad is one of the most promising freshwater fish species tried as baitfish for skipjack tuna to date. The species is fecund, has many of the attributes of a good baitfish in terms of color, size and swimming behavior, is able to tolerate both fresh and

salt water, and is relatively hardy. Limited trials by NMFS research vessels have demonstrated that the threadfin shad can be used effectively for catching skipjack tuna. Unfortunately, a 1-month trial of threadfin shad on a commercial Hawaiian sampan provided results that were inconclusive. The lack of a notable measure of success has been partly attributed to nonfishing related problems encountered by the vessel operators.

Before proceeding with work on the culture aspects of threadfin shad, intensive field acceptability trials should be carried out using threadfin shad taken from wild stocks in Wahiawa Reservoir. The proposed project is to have available to the Hawaiian skipjack tuna vessels an adequate supply of threadfin shad for an extended period. These shad should be made available at no cost to the fishermen. In return for the baitfish, the vessel will be required to provide data on catch and effort. These field trials should be conducted under conditions closely approximating actual commercial pole-and-line fishing operations. Adequate numbers of fishing trials should be repeated so that conclusive answers can be obtained on the acceptability of threadfin shad.

In the event the fishermen find that threadfin shad is acceptable as a baitfish and this is conclusively demonstrated, the plan is to initiate studies for the intensive culture of threadfin shad and to examine the economics of such a culture system.

Subactivity b.--Conduct field trials using golden shiners, Notemigonus crysoleucas, in the Hawaiian fishery.

This subactivity is proposed as an alternative project, should Subactivity a fail. Some preliminary work with golden shiners have been done by Pacific Aquaculture Corporation (PAC) on the island of Maui under contract with NMFS. The preliminary work suggested that golden shiners were effective for chumming skipjack tuna. However, more field work is needed to conclusively determine the acceptability and effectiveness of golden shiners. The Maui bait holding facilities may be available for this work at nominal cost.

The principal disadvantage of using shiners as a baitfish for skipjack tuna is that the species cannot be acclimatized to sea water. While a relatively inexpensive closed freshwater recirculating system may be devised for short-term application on a skipjack tuna boat, it is unlikely that the golden shiners can be carried on extended fishing trips, e.g., 3-4 weeks.

In conducting field trials, care should be taken that the trials are carried out by fishermen who are not biased against the use of new bait species. Some of the past experiences of NMFS have indicated that part of the failures of species used experimentally as bait can be attributed not to the shortcomings of the baitfish but to the "negative" outlook of the fishermen towards the baitfish.

Subactivity c.--Conduct extensive field trials using the sharpnose mollies, Poecilia sphenops, in the American Samoa area.

Skipjack tuna are reported to occur in commercial quantities in waters around American Samoa. The major handicap in developing a commercial pole-and-line fishery for skipjack tuna is that there is a virtual lack of suitable baitfish in waters around American Samoa. The options available to American Samoa in culturing baitfishes are limited since a number of species considered for use in Hawaiian waters cannot be reared in American Samoa; e.g., the ambient water temperatures encountered in American Samoa probably are too high for successful propagation of the threadfin shad. The lack of large reservoirs also makes the possibility of establishing wild stocks of threadfin shad improbable.

Mollies have been tried on several occasions in American Samoa with success. The outlook for the use of this species on a commercial scale appears promising. It is believed that modifications of fishing gear used and the fishing operations will increase the successful use of this baitfish.

The Government of American Samoa is currently conducting a program to culture an adequate supply of sharpnose mollies for subsequent field trials. As of this date, it appears that the culture program will require a substantial increase in personnel and funding to reach a stage where adequate supplies of mollies can be cultured for the field trials.

Activity 3. Pilot bait culture facility.

As the conclusive effectiveness of new potential baitfishes are experimentally determined, studies should be conducted on the economics and biology of their culture on a commercial scale. For species that are determined to be economically and biologically amenable to culture, pilot plant production experiments on a commercial scale should be initiated.

Activity 4. Bait substitutes.

The existing literature on bait substitute work will be compiled and evaluated. Using this as a base new possibilities will be explored in the use of artificial bait and other bait substitutes for skipjack tuna pole-and-line fishing.

Activity 5. Development of an optimal fishing strategy for the Hawaiian pole-and-line fishery for skipjack tuna.

Presently NMFS is conducting trials to determine the feasibility of economically transporting the northern anchovy from California to Hawaii as a means of solving the baitfish problem. NMFS is also planning to test in 1975 the Japanese automatic pole-and-line device on a Hawaiian sampan to determine its feasibility in catching skipjack tuna in tropical waters. Assuming some success in these two projects, it is feasible that a package could be developed which would incorporate

the disparate parts into a single system. Any measure of success would be a substantial economic gain.

A pilot study could be conducted during 1975 by incorporating the system on the Hawaiian skipjack tuna vessel, the Anela. The circumstances are ideal for the Anela.

The plan would be to have the Anela reduce its crew by 50% (5 men?) and develop a system to provide a continuous supply of northern anchovy to the Anela. If successful the Anela should demonstrate a substantial economic gain; the gain to be achieved by (a) a substantial increase in fishing effort due to eliminating the baiting operations and (2) an increase in profits by virtue of crew reduction (assuming no reduction in catch/effort) and a reduction in operating expenses, e.g., food, and elimination of running time for baiting.

Activity 6. Design bait fishery module and infrastructure.

In many areas where skipjack tuna fisheries do not currently exist and employment is low, the administration prefers development of a local fishery using local people. Because it is less capital-intensive, the operation of a pole-and-line fishery is more suitable than a purse seine fishery. This project will seek to assist the various administrators of the region in developing a suitable localized fishery.

Activity 7. Management of baitfishes.

This study will involve a continuing assessment of the status of the populations of naturally occurring baitfishes in the central and western Pacific. Aspects of the study should include investigations into the biology and behavior of established baitfishes to determine proper handling techniques to reduce mortality.

Activity 8. Extension service.

Although new baitfishes which are experimentally determined to be effective may be found, there will be a problem of their acceptance by the commercial fishermen. A continuous program is needed to work with the fishermen to inform them of the advantages and benefits of using new baitfishes and to keep them informed of other advances made in gear technology.

Activity 9. Fishery liaison work.

The recent interest in developing the skipjack tuna resources of the Pacific region has resulted in rapid shifts in the views for planning and implementing fisheries in the area. A conscious effort is needed to keep up with these developments.

Activity 10. Literature search and evaluation of skipjack tuna fishery data.

Existing foreign and domestic tuna fishery information and statistics along with reports of past tuna exploration and oceanography will be compiled and evaluated to determine promising areas for exploration. The study will concentrate on providing accurate assessments of the variation and average levels of school size, frequency of schools encountered and size of fish.

ESTIMATED COSTS
(In thousands of dollars)

Activity 1

Supervisor (GS-11 equivalent, 16 months)	23.4
Technician (GS-3 equivalent, 16 months)	10.2
Vessel (260 days @ \$1,800/day)	<u>468.0</u>

501.6

Activity 2

Subactivity a

Supervisor (GS-11 equivalent, 6 months)	8.8
Technician (GS-3 equivalent, 6 months)	3.8
Labor, collecting shad (8 men, 80 days)	13.7
Transport (borrow NMFS tank trailer), gas, driver	5.0
Purchase and install 6 swimming pools	10.2
Land rental	0.2
Fish food	0.3
Pumps	<u>18.0</u>

60.0

Subactivity b

Project supervisor (GS-11 equivalent, 6 months)	8.8
Technician (GS-4, 6 months)	4.3
Purchase of 400 buckets of golden shiners	4.6
Freighting golden shiners to Honolulu	0.6
Transport golden shiners Honolulu-Maui (use NMFS tanker trailer, Young Bros. tug)	0.6

Holding facility Maui (lease)	1.2	
Fresh water, electricity, pumps	3.6	
Fish food	0.1	
Miscellaneous	0.3	
Field observers (2 observers, GS-9 equivalent, 3 months)	<u>7.4</u>	31.5
Subactivity c		
Labor	13.5	
Build brood and holding facility	30.0	
Fish food	<u>0.2</u>	43.7
Activity 3		
Supervisor (GS-11 equivalent, 12 months)	17.5	
Technician (GS-3 equivalent, 12 months)	7.7	
Construction and equipment	70.0	
Operation	<u>16.0</u>	111.2
Activity 4		
Investigator (GS-11 equivalent, 9 months)		13.2
Activity 5		
Purchase and install automatic pole and line	25.0	
Bait transport (16 trips)	28.7	
Holding facility in Long Beach (6 holding tanks)	40.2	
Operating cost of holding facility (9 months)	40.0	

Baitfish purchase	6.4	
Holding facility in Honolulu (2 holding tanks)	6.7	
Operating cost of holding facility (9 months)	<u>15.0</u>	162.0
Activity 6		
Investigator (GS-2 equivalent, 10 months)		17.4
Activity 7		
Supervisor (GS-12 equivalent, 9 months)	15.7	
Technician (GS-3 equivalent, 9 months)	<u>5.8</u>	21.5
Activity 8		
Investigator (GS-11 equivalent, 3 months/year, 3 years)		13.2
Activity 9		
Investigator (GS-11 equivalent, 3 months/year, 3 years)		13.2
Activity 10		
Investigator (GS-11 equivalent, 6 months)	<u>8.8</u>	
Subtotal		997.3
Overhead (10%)	<u>99.7</u>	
Total		1,097.0

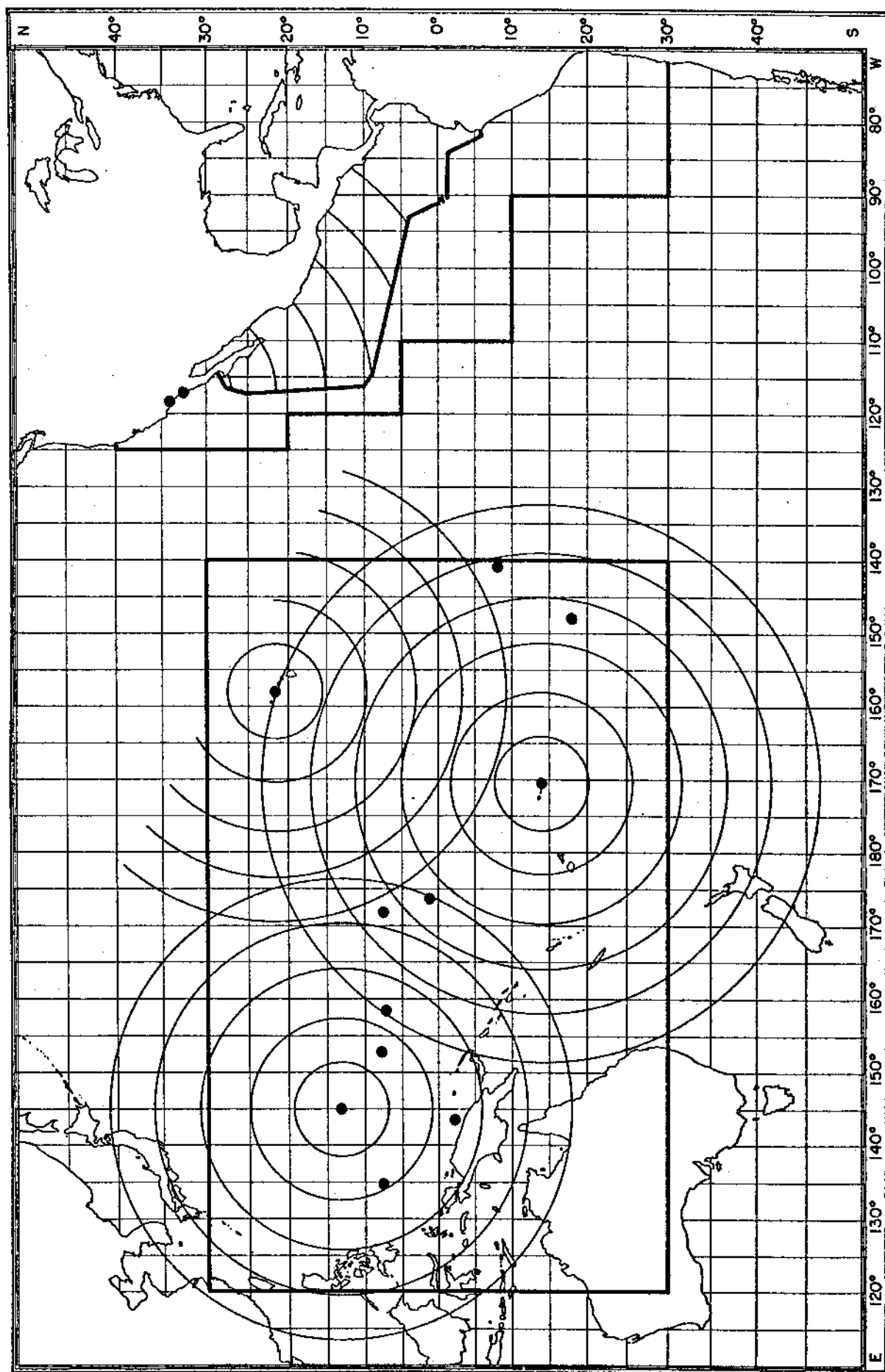


Figure 1.--Area of proposed skipjack tuna fishery development work.

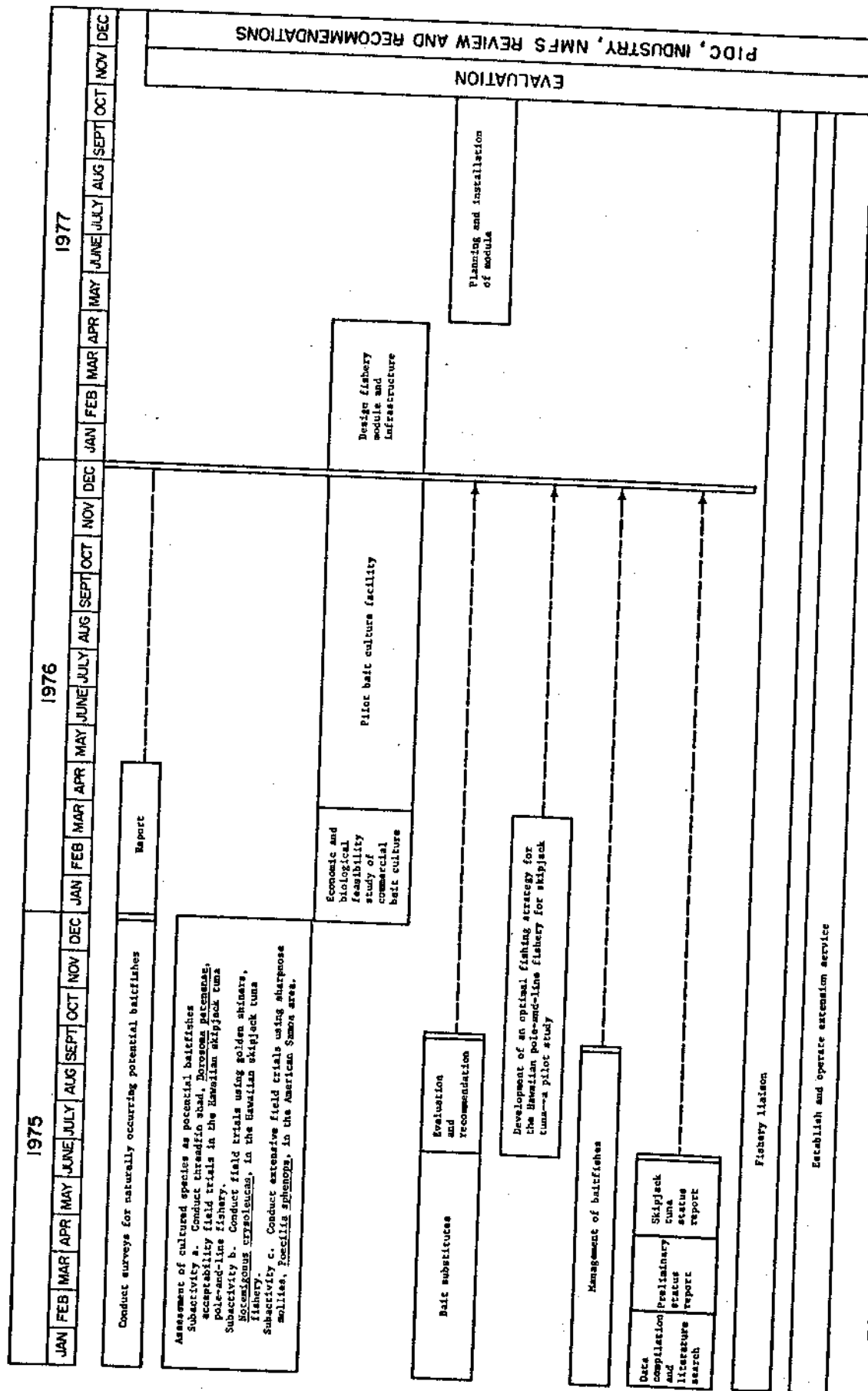


Figure 2.--Suggested activity network for the development of live-bait, pole-and-line fisheries for skipjack tuna in the central and western Pacific Ocean.